АКТУАЛЬНІ ПРОБЛЕМИ ЗАСТОСУВАННЯ ТЕОРІЇ І ПРАКТИКИ МАРКЕТИНГУ

UDC 657.471.66:338.45

V. I. KOVSHIK
National Technical University "Kharkiv Polytechnic Institute"

DISTRIBUTION COSTS OF UKRAINIAN MECHANICAL ENGINEERING ENTERPRISES

The article presents the exploration of characteristics and behaviour of distribution costs of mechanical engineering enterprises of Ukraine in the context of logistics expenses investigation. The study is focusing on actually working Ukrainian companies that shows their financial statements as obligatory accountability for securities emitters. The key method used is a statistical analysis of distribution costs values in income statements for 2012–2014 financial years across 70 enterprises in this sphere. On the basis of correlation and frequency analysis, the work describes important relationships and common behaviour patterns between distribution costs, sales volumes, manufacturing expenses, firm staff size and sphere of its activity. The analysis discovered that in most of active mechanical engineering enterprises in Ukraine the distribution costs fit the range from 1 to 10% of revenue amount with the total sample average about 4%. Deviations according to the produced machinery or equipment type are also studied and presented in the article that makes significant importance of the obtained results for managerial and scientific activities.

Keywords: distribution costs, cost management, supply chain management, financial statements analysis, statistics, mechanical engineering.

В. І. КОВШИК
Національний технічний університет «Харківський політехнічний інститут»

ВИТРАТИ ЗБУТУ МАШИНОБУДІВНИХ ПІДПРИЄМСТВ УКРАЇНИ

В статті представлено дослідження характеристик і поведінки витрат збуту машинобудівних підприємств України в контексті вивчення логістичних витрат. Дослідження фокусується на українських компаніях, що активно функціонують, та розкривають свою фінансову звітність як емітенти цінних паперів. Основним методом дослідження є статистичний аналіз значень витрат збуту в звітах про доходи та витрати за 2012–2014 фінансові роки 70 підприємств у цій сфері. На підставі кореляційного та частотного аналізу, в статті описано важливі відношення, закономірності та взаємозв'язки між витратами збуту, обсягами продажів, собівартістю, розміром підприємства і його штату, сферою його діяльності. Проведений аналіз виявив, що в більшості активних підприємств машинобудування в Україні витрати на збут відповідають діапазону від 1 до 10% від суми чистого доходу з середнім значенням даних вибірки близько 4%. Відмінності від середніх показників відповідно до типу техніки або обладнання, що виготовляється, також досліджено і представлено в статті, що становить велике значення отриманих результатів для практичної управлінської та наукової діяльності.

Ключові слова: витрати збуту, управління витратами, управління ланцюгами постачання, аналіз фінансової світності, статистика, машинобудування.

Introduction

Taking into account the difficult economic conditions caused by an intensification of the economic crisis and a difficult socio-political situation in Ukraine, the problem of effective cost management is increasingly crucial for surviving and further development of all major branches of production. Reorientation of material and information flows towards new markets in the context of Ukraine's integration to European Union as well as disappearance of old logistics patterns are also powerful stimulating factors for Ukrainian companies to find out ways of improvement and development. The cost of finished goods distribution is an important part of the total and logistics cost at any industrial enterprise. Mechanical engineering companies are not an exception. They face many problems nowadays and this fact is causing the high urgency of the scientific studies in the sphere of costs management.

Analysis of recent researches and publications

The problems of effective cost management in distribution part of supply channels at various types of enterprises, place of such costs in overall structure and common directions of their allocation are considered on the works of numerous Ukrainian and foreign authors. Among them, there are the following scientists: L. M. Yancheva, V. I. Ospishchev, K. Bezvervkhyi, O. Lotysh, A. V. Tkachova, O. B. Telishevska, M. Christopher and others. These authors emphasize the importance of investigation of logistics costs and distribution costs as their integral part.

L. M. Yancheva, V. I. Ospishchev and N. M. Harkusha [1] in the work on factor analysis of distribution costs of trade companies, emphasize the importance of distribution analysis and provides information on using income statement data for the related research. K. Bezvervkhyi [2] and A. V. Tkachova [4] in their work state that distribution costs are an important part of indirect and logistics costs of any enterprise. O. Lotysh [3], provides some general data about foreign enterprises and a content of logistics costs by functional direction, but the article does not contain exact data for Ukrainian enterprises. O. B. Telishevska [5] reveals the main factors that have an impact on distribution costs as an integral part of logistics costs and provides a theoretical basis for usage of financial statement data in research. M. Christopher [6, p. 98–100] describes the general methodology of distribution logistics

costing and offers several conclusions on the problems of distribution costs accounting companies can face.

Therefore, Ukrainian and foreign scientists provide theoretical basis and background for investigation of such costs, but there are no recent statistical data about actual amounts of such costs being experienced by Ukrainian enterprises as well as their main features, especially in reference to mechanical engineering enterprises functioning. These facts determines the importance of the following research aim and tasks.

Aim of the research

The aim of the research is to reveal basic features and patterns in distribution costs at enterprises that produce machinery and equipment in Ukraine. Based on the aim it is possible to formulate the following tasks: to find out ways to investigate distribution costs at mechanical engineering enterprises of Ukraine, to perform a statistical analysis to characterize comprehensively such costs and to define their amounts depending on external and internal factors, and to prepare background for further studies.

Research methodology

According to the National standard of accounting №16 "Costs" [7], distribution costs that are disclosed by enterprises in their financial reports (i.e. income statement) includes the following items:

– costs of packing materials used for finished production;
– expenses on packaging repairs;
– salary of sellers, trade agents and distribution staff members;
– marketing and advertising costs;
– expenses on pre-sale preparation of products;
– expenses on distribution-related business trip;
– costs of related assets handling and maintenance (including rent, insurance, repairs, electricity, security etc.);
– costs of finished goods transportation to final customers and/or distributors according to delivery conditions and terms, transportation between subdivisions of enterprise;
– warranty costs;
– insurance of finished products stored at warehouses and other costs related to distribution.

From the given list, it is obvious that most part of these costs belongs to logistics processes. Only the small part is related to marketing, especially on enterprises in heavy industries including mechanical engineering. It is due to the specificity of marketing activities of such companies: they work generally with individual ordering parties in business-to-business manner and do not spend significant financial resources on promotion and market research like producers of consumer goods.

The formulas of outbound (distribution) logistics costs that are being provided by several authors [4, 8], state that logistics costs of distribution include transportation, warehousing, goods handling costs, expenses on informational support, insurance, export fees, costs of distribution network functioning. Taking into account the aforementioned norms of accounting, this fact can be a basis for an assumption that distribution costs reflected in the income statement of an industrial enterprise can be used to investigate logistics costs of machinery producers on the stage of finished goods distribution. This assumption allows evaluating such costs in the process of logistics analysis with ease and sufficient level of accuracy.

Ukrainian enterprises that are joint-stock companies are obliged to disclose their financial statements that are collected on several government web-databases. Therefore, the main source of information used for this research is an information from annual income statements of actively functioning joint-stock companies that operate in the sphere of mechanical engineering. They are officially published on the web site of Stock market infrastructure development agency of Ukraine and are freely available [9].

The sample was constructed from data of income statement reports for 2012–2014 years of 70 enterprises, involved in various types of mechanical engineering including manufacturing of machine tools, handling equipment, engines, compressors, agricultural and military equipment, turbines, trains and ships. The enterprises represents only functioning enterprises and only those that main activity belongs to mechanical engineering. Enterprises that perform mainly services or produce only complementary goods for equipment as well as metal parts were excluded from sample to ensure the reliability of obtained results. The enterprises represent 18 regions of Ukraine excluding territories that are temporary occupied since 2014. This exclusion was made to simplify further investigations based on newer data in spite of the fact the current analysis is based on 2012–2014 data.

The methodology of the study includes calculation of simple Pearson's product-moment correlation coefficient between distribution costs and other enterprises results. Value of 1 shows a total positive correlation, 0 is an absence correlation, and −1 is an indicator of total negative correlation. It is calculated by formula (1).

$$r = r_{xy} = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2}\sqrt{\sum_{i=1}^{n}(y_i - \bar{y})^2}}, \quad (1)$$

where x_i — first dataset's item;

y_i — second dataset's item;

$\bar{x}$ — first dataset mean;

$\bar{y}$ — second dataset mean.

Research results

The results of correlation analysis obtained on the given sample for 2012–2014 data are shown in the following table 1. The high coefficients showing the correlation between revenues, production cost and gross profit are expectable and supports the knowledge that distribution costs are in high degree dependent on volumes of production. It is possible to conclude that for mechanical engineering enterprises the distribution expenses are semi-variable including high percentage of variable costs. It is possible to notice that the actual value of distribution costs is not directly connected with net income of the enterprise.

Table 1

Pearson's correlation coefficient between distribution costs and other indicators from financial statements

Indicator	Correlation coefficient by years		
	2012	2013	2014
Number of employees	0,816	0,877	0,705
Revenue	0,736	0,781	0,701
Cost of production	0,701	0,765	0,622
Gross profit	0,848	0,743	0,809
Net income	0,288	0,062	-0,002

To confirm additionally the aforementioned thesis about semi-variable nature of distribution costs it is possible to calculate a degree of changes on each enterprise in volume of production costs, changes in sales volume, and a degree of changes in distribution costs. This data about changes also can be analyzed using the correlation analysis to define a connection between these data. The calculations with the formula (1) show that changes in distribution costs in 2012–2013 are related to change in sales with the correlation coefficient 0,696, and coefficient 0,756 for production costs, that confirms previous conclusions about semi-variable character of these costs.

The relative value of distribution costs in the total structure of company's expenses is next one of the most important indicators that describes the distribution itself and company's performance in dynamics as well [10].

Investigation of the given sample frequency distribution reveals that fact that most enterprises' distribution cost amount lies in the range of 1–6% of sales or with a peak circa 4% value. The average ratio (distribution costs to sales) is 3,49% in 2012, 4% in 2013 and 4,08% in 2014. In less than 10 cases, this ratio is in the range of 6–10%. In 2013 two enterprises showed significant deviation (18,7% and 16,5% to sales; 27,75% and 26,6% to production costs) due to significant changes in companies' performance. In 2014 the situation was very similar to the previous year with one enterprise showing 22,05% ratio to revenue and 34,65% to manufacturing costs. The detailed histograms on figures 1 and 2 illustrate results of the analysis by percent intervals with inclusive upper value.

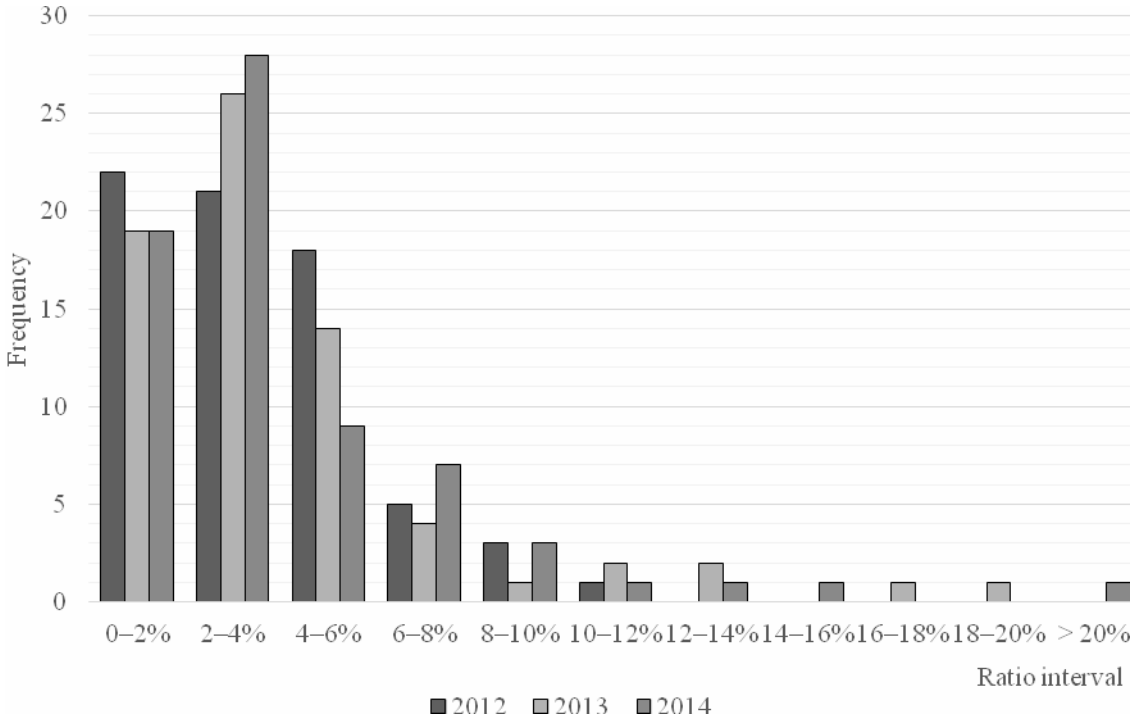

Fig. 1. Ratio of distribution costs to the amount of net revenue. Frequencies in the analyzed sample.

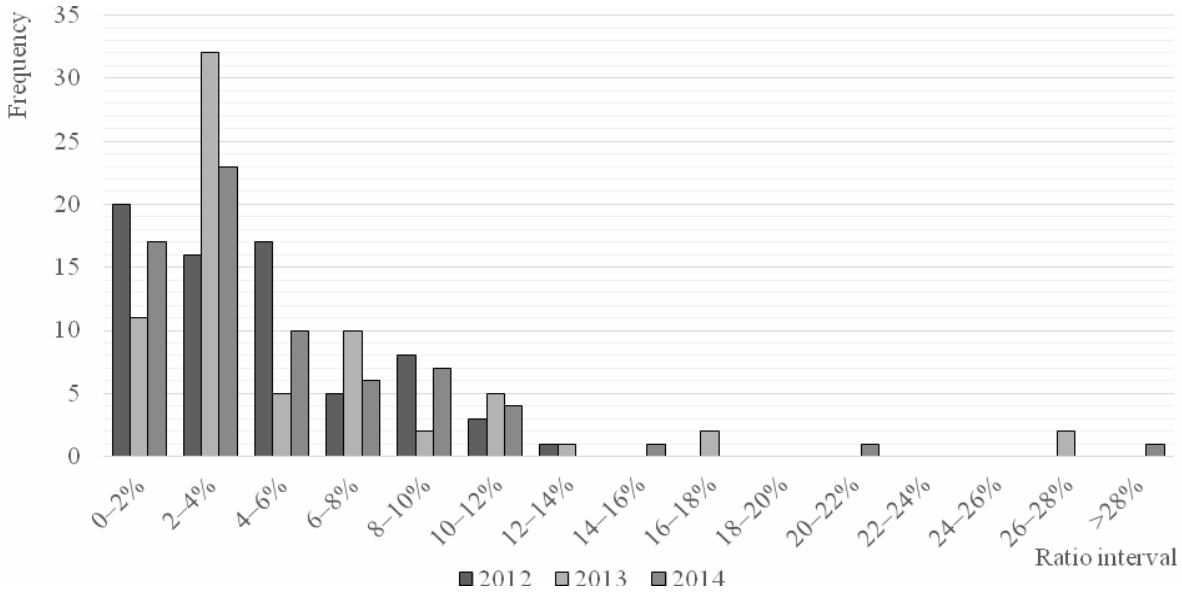

Fig. 2. Ratio of distribution costs to the manufacturing costs. Frequencies in the analyzed sample.

The next important information that can be found out from statistical analysis of the sample is a dispersal of the enterprises by distribution costs percentage according to a type of goods produced. An analysis of companies' main activities revealed the following 15 groups of products, presented in the table 2. The table include values in percent that show an amount of distribution costs relatively to the volume of production in monetary form (revenue).

Considered product groups shows significant difference in amounts of studied costs. As seen from table 2, the highest average amounts of distribution costs are intrinsic for a production of electric engines, generators, energy and building equipment, filters, valves, boilers, wastewater treatment systems, hydraulic equipment. This is obviously related to the relative batch sizes, ways of products distribution, differences in packaging etc. The detailed factor analysis can be an objective of a future research in this sphere.

Table 2

Average distribution costs to revenue ratio at the discovered enterprises by product groups

Products	Distribution costs to revenue ratio (average for product group)			
	2012	2013	2014	Average
Engines, generators	5,06%	8,27%	9,76%	7,70%
Energy equipment, metal products	4,44%	4,17%	8,66%	5,76%
Equipment for construction and production of building materials	4,85%	5,40%	5,92%	5,39%
Filters, valves, boilers, wastewater treatment systems, hydraulic equipment.	4,54%	6,86%	4,45%	5,28%
Pumps, compressors, cooling equipment, air conditioning, power equipment	4,34%	5,00%	3,93%	4,42%
Equipment for food industry and agriculture	3,85%	4,10%	3,42%	3,79%
Equipment for the chemical industry and petroleum processing	2,49%	3,47%	5,39%	3,78%
Lifting and transporting equipment	5,02%	3,08%	2,90%	3,67%
Cars and motor vehicles, parts	3,32%	3,20%	3,36%	3,30%
Equipment for mining industry and metallurgy	2,57%	2,70%	2,72%	2,66%
Metal processing machinery	1,95%	2,44%	2,02%	2,14%
Boats and ships	1,59%	2,90%	1,90%	2,13%
Measuring and navigation devices	2,64%	1,38%	2,08%	2,03%
Railroad cars and rail equipment	1,33%	1,14%	3,27%	1,91%
Communications equipment	0,56%	1,83%	3,18%	1,85%

Summary

As a result of the research it is possible to make the following conclusions. The distribution costs calculated on the basis of norms of financial accounting in the case of mechanical engineering enterprises consist primarily of

logistics costs. This makes possible to investigate logistics costs features in distribution sphere with the statistical analysis of income statements of joint-stock companies. The analysis revealed that in active mechanical engineering enterprises in Ukraine the distribution costs fit the range from 1 to 10% of sales volume. In outstanding cases, this value can be less than 1% or more than 10% and can reach 24% of sales or even amount of 34 % of production costs size. The average value is about 4% of sales (4,04% in 2014). These costs have semi-variable character and are highly related with volumes of produced goods as well as in even higher degree with quantity of people involved in that logistics activities. Distribution costs show a discrepancy according to the goods produces by the enterprises. The analysis of the sample allows distinguishing 15 main product groups according to the enterprises main activity, that influence on average values of distribution costs. The least values (~2%) reside such branches as communication and railroad equipment, and ships building. The most values belongs to production of devices such as motors, filters, valves, boilers, building equipment etc (5–7%).

The future studies can be aimed to find out the relative impact of various additional factors (target audience and size of products, geographic location etc.) on distribution costs and investigation of ways to predict amounts of such costs on a variety of enterprises. Further researches must also include investigation of factors that cause significant deviations in analyzed data at some enterprises. In addition, it is needed to find out exact content of marketing expenses in distribution costs that was neglected in this research in comparison with total distribution costs volume.

References

1. L. M. Yancheva, V. I. Ospishchev, N. M. Harkusha, “Faktornyi analiz vytrat na zbut pidpryiemstv rozdribnoi torhivli”, Ekonomichna stratehiia i perspektyvy rozvytku sfery torhivli ta posluh, No. 1 (1), Kharkiv, 2009, pp. 3–12.

2. K. Bezverkhyi, “Klasyfikatsiia nepriamykh vytrat u systemi upravlinskoho obliku”, Visnyk Kyivskoho natsionalnoho torhovelno-ekonomichnoho universytetu, No. 4, 2009, pp. 106–116.

3. O. Lotysh, “Upravlinnia lohistychnymy vytratamy na pidpryiemstvi”, Ekonomichnyi analiz. Ternopilskyi natsionalnyi ekonomichnyi universytet, No. 2, 2008, pp. 240–243.

4. A. V. Tkachova, “Lohistychni vytraty yak kryterii optymizatsii lohistychnoho upravlinnia”, Naukovi pratsi Donetskoho natsionalnoho tekhnichnoho universytetu. Seriia: Ekonomichna, No. 36, Vol. 2, 2009, pp. 88–93.

5. O. B. Telishevska Faktory, yaki vyznachaiut vytraty na lohistychno-postachalnytsku diialnist pidpryiemstva, Naukovyi visnyk NLTU Ukrainy, No. 17, 2013, pp. 390–397.

6. Christopher M. Logistics And Supply Chain Management: Creating Value-Adding Networks, 3rd edition, Edinburgh: Pearson Education Limited, 2005, 336 p.

7. “Pro zatverdzhennia Polozhennia (standartu) bukhhalterskoho obliku 16 “Vytraty”, Order of the Ministry of Finance of Ukraine from 31.12.1999 No. 318 (updated 09.08.2013), http://zakon3.rada.gov.ua/laws/show/z0027-00.

8. L. A. Kazarina, “Logisticheskie izderzhki: problemy ucheta i ocenki”, Vestnik Tomskogo gosudarstvennogo pedagogicheskogo universiteta, No. 9, 2007, pp. 24–27.

9. Stock Market Infrastructure Development Agency of Ukraine, (accessed 25.05.2015) http://smida.gov.ua/db/emitent.

10. N. V. Tsopa “Metodika ocenki dinamiki funkcionirovaniya predpriyatiya krupnogo mashinostroeniya”, Visnyk Khmelnytskoho natsionalnoho universytetu. Ekonomichni nauky, No. 3, 2009, pp. 142–149.

Надійшла 08.05.2015; рецензент: д. е. н. Краснокутська Н. С.